GEOTRAVERSE ACROSS THE XANTHE TERRA - CHRYSE PLANITIA TRANSITION ZONE, MARS

L. S. Crumpler, *New Mexico Museum of Natural History and Science, 1801 Mountain Rd NW, Albuquerque, NM 87104*

INTRODUCTION. High-resolution (1:500,000-scale) photogeological mapping of a strip (300 km wide and 1500 km long), or geotraverse, across the transition from the Xanthe Terra cratered highlands to the Chryse Planitia lowlands further defines geologic units at a low latitude site along the highland-lowland boundary in an area relatively unmodified by catastrophic outflow channels. Because the Viking 1 Lander (or Mutch Memorial Station) lies along the geotraverse, mapping in this region has also enabled placing the lander scale observations in a regional stratigraphic framework. Observations here also may have some bearing on an understanding of the geology of the Mars Pathfinder landing site. Although the Mars Pathfinder site ([1]; 900 km east-southeast of the Viking 1 Lander) lies closer to the local highland-lowland transition, and has been subjected to more extensive local modification from outflow channels, the geologic setting is regionally similar to the Viking 1 Lander site.

SUMMARY OF GEOLOGIC UNITS. The traverse crosses ancient cratered highlands to lowland ridged plains and catastrophic outflow channels and encompasses surface materials ranging from some of the oldest to some of the youngest on Mars. Crater abundances and degradation states vary systematically from highland to lowland in accordance with relative ages determined from observed overlapping and embayment relations between geologically defined surface units. In general order of decreasing age defined units include [2]: (1) *Massifs and Hummocky terrain(unit Nh),* characterized by relatively flat upper surfaces or irregular peaks with steep and locally fluted slopes, and exceed several hundred meters in relief based ; (2) *Highland Craters* subdued, locally incised, and surrounded by low-relief "intercrater plains"; (3) *Intercrater Plains (unit Nip),* generally featureless, but exceptions include areas where faint discontinuous traces of valley networks , perhaps more common than is currently assumed since short discontinuous segments of valleys may be distinguished throughout the intercrater plains; (4) *Boundary plains (unit NHbp)*thickens northward and inundates highland topography and rimless craters, resulting in the distinctive smooth appearance of the transition zone; (5) *Valley floors and walls (unit Hv)* associated with several long valley networks, extend across both the highland surface and lower surfaces in the highland side of the highland-lowland transition, the largest of which exceed several hundred kilometers in length; (6) *Smooth plains (unit Hsp)* within the lowlands that include pervasive, notably subdued wrinkle ridges and a moderate abundance of craters, many filled to the rim with an easily eroded material; (7) *Hilly plains (unit Hhp)* occurring as widely and randomly distributed domical to table-topped hills generally less than 2 km in basal diameter throughout the lowland side of the transition zone; (8) *Lower ridged plains and upper plains (units Hr and AHp)* similar to Hesperian age ridged plains units that occur elsewhere within the northern hemisphere of Mars [2]; (9) *Channeled plains (unit Hchp) and channel floors (unit Hch)* characterized by numerous arcuate to linear and approximately parallel ridges, valleys, linear striations, elongate ridges, and troughs cut into the surfaces of the lower ridged plains (unit Hr) and the western areas of the upper plains (unit AHp).

GENERAL RESULTS. Two types of highland-lowland boundary are identified: (1) a topographic boundary and (2) a geologic/morphologic boundary. The topographic boundary occurs well within the cratered highlands and separates a lower-standing cratered highland surface with transitional characteristics from the true highland surface. The lower highland surface, or transition zone, appears to have been only partially inundated by plains-forming materials, interpreted to be plains type lava flows of late Noachian-early Hesperian age similar to later basin-fill material forming Hesperian-aged ridged plains. The geologic boundary is identified with the traditional boundary as mapped in previous studies and denotes the transition from cratered highland type surface morphology to ridged lowland plains surface morphology.

A moat-like region lies between the geologic boundary and the basin interior. Erosion of the deposit within this moat along the outer margins of the Chryse basin during formation of outwash channels appears to account for the streamlined tables formed throughout the southern and western margins of Chryse Planitia.

The geology of the central basin interior, where the Viking 1 Lander is located, is consistent with the presence of fluvial sediments derived from both the adjacent highlands and remobilized from the marginal mantling unit within the moat-like region and deposited near the termini of the Maja and Kasei Valles outflow channels.

Similar boundary plains may occur elsewhere long the margins of Chryse Planitia because the plains-forming lavas responsible for the boundary plains unit on the slopes of Xanthe Terra may have overlain much of the proximal portions of the highlands around the margins of the basin prior to outflow channeling. This means that boundary plains lavas might occur as the substrate for the proposed Mars pathfinder landing site, or occur as units that have been eroded and carried downstream from farther up the Ares Vallis channel system. Rocks within the outwash deposits of Ares Vallis and other channels around the margins of Chryse basin may be a mixture of plains volcanic rocks of the type responsible for the boundary plains and true ancient highland (breccia) rocks. Highland rocks may be less abundant than otherwise anticipated in the outwash sediments from Ares Vallis. True highland rocks could be a small component of any outflow channel sediments even in settings near the basin margin. If so, local sediments eroded from the highlands by outflow channels could contain a significant component of materials similar to interior plains lavas and to layered mantling deposits rock populations. Sediments at the proposed Mars Pathfinder site, located near the geologic boundary further east, could contain a significant portion of materials typical of lowlands in addition to "highland" materials.

REFERENCES. [1] Golombek et al., 1997, *Jour. Geophys. Res.*, in press; [2] Crumpler, 1997, *Jour. Geophys. Res., in press*; [3] Scott, D. H., and K. L. Tanaka, 1986, *U. S. Geological Survey Miscellaneous Investigation Series Map I-1802-A.*

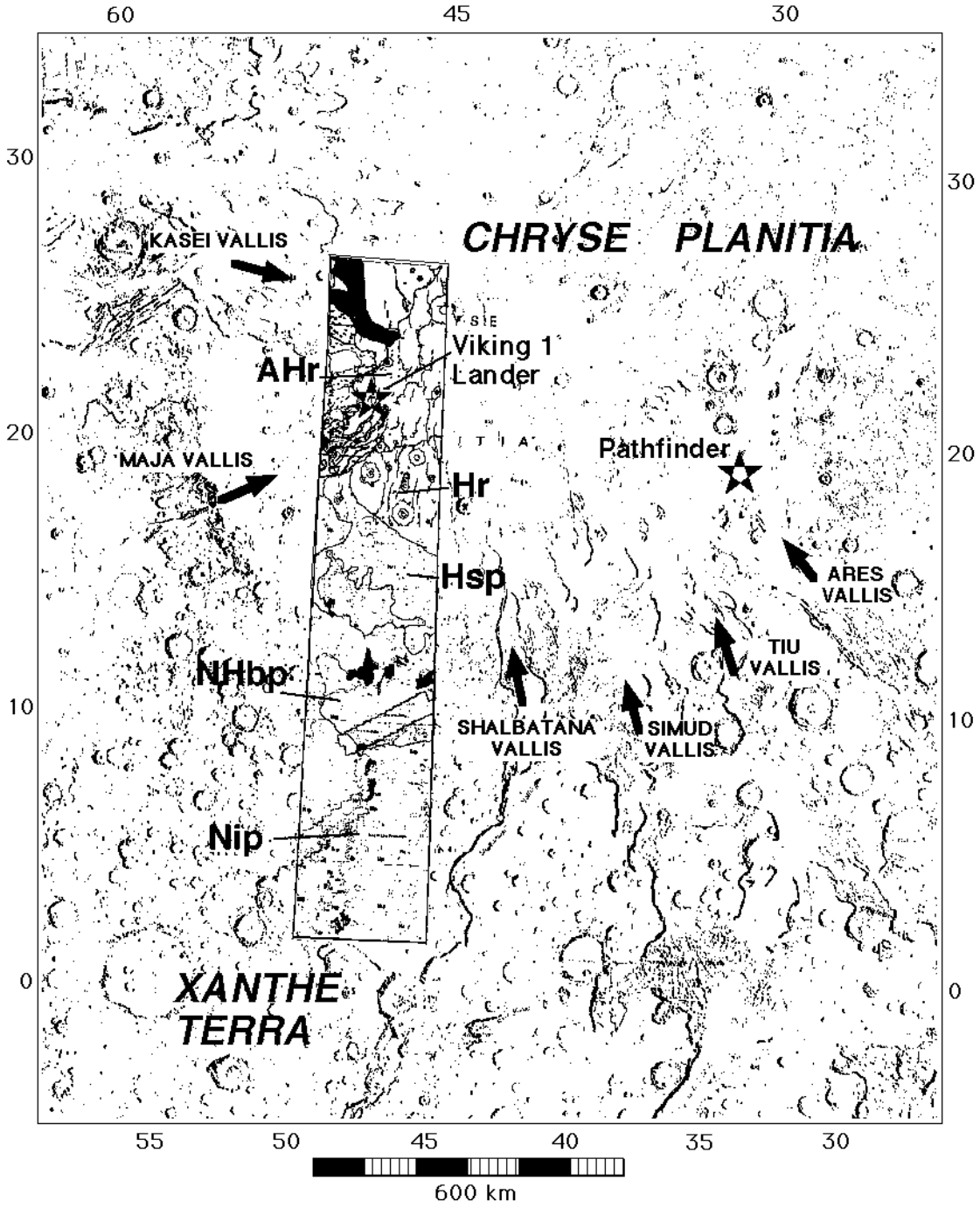

Figure 1. Geotraverse from Xanthe Terra highlands to Chryse Planitia lowlands overlain on regional shaded relief map. Principal geologic units discussed are indicated. The boundary plains (NHbp) are geologically transitional to the inter-crater highland plains (Nip) and lowland plains (Hr). Mars Pathfinder lies close to the transition zone and boundary plains compared with the Viking 1 Lander. The Pathfinder site lies within what is interpreted to be fluvially modified smooth plains material (Hsp) and boundary plains material; whereas the Viking 1 Lander lies within fluvially re-worked and re-deposited smooth plains material.